pituitrin was used and occasionally three doses were required. Such results indicate that labor may be prolonged by the use of scopolamin and narcophin, and this question is considered in some detail by Siegel. As a basis of comparison he selects primiparous women who were not given the treatment and finds that in similar cases in which the treatment was used the first stage was prolonged an hour and twenty-two minutes, the second stage thirty-three minutes. The frequency of operations in this series of 220 cases was 10%, which is about the same operative frequency when "twilight sleep" is not induced.

Other effects of the treatment upon the mother include a peripheral hyperemia, especially of the face. Marked excitement occurred in six cases and this symptom would seem the more likely to occur when labor is prolonged and consequently a great number of doses of the drug required. No respiratory embarrassment in the mother occurred in any instance. Similarly the use of this treatment does not predispose patients to postpartum hemorrhage nor does it interfere with lactation. Indeed, a more rapid and satisfactory convalescence from childbirth, it is claimed, follows the use of "twilight sleep."

The infants, in this series of cases, were of normal development. In 148 instances the fetus was uninfluenced by the drugs. A light apnea was noted in 61 instances, severe apnea in 6, and deep asphyxia in 4. Two infants were dead born and one living child, because the mother had high fever, was the subject of a destructive operation. Furthermore, two of the deeply asphyxiated infants could not be resuscitated. The author computes a fetal mortality of 2.15% referable to the use of "twilight sleep."

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THE RELATION OF THE PERIOSTEUM TO BONE VITALITY.*

By R. T. STRATTON, M. D., Oakland.

Notwithstanding the mass of clinical experience tending to establish the function of the periosteum in its relation not only to bone production but also to the maintenance of the vitality of the bone, there is still much misunderstanding or variance of opinion on both of these points. Whether it has positive and active osteogenic properties, as has long been held and is still strongly maintained, or whether it has no higher function than to serve as a supporting and limiting membrane, will not now be considered. It is the purpose of this paper, rather, to discuss how much the periosteum has to do with sustaining the life of bone. The decisive bearing of this upon prognosis and treatment of osseous lesions is evident.

There is a unanimity of opinion that under aseptic conditions, the overlying soft structures being *in situ,* the presence of the periosteum is *not* essential to the continued vitality of the bone. This we see frequently enough in the open treatment of fractures where the periosteum may be widely detached or missing and yet the reparative process will go on practically unhindered.

Investigators have removed the periosteum experimentally from large areas over the entire circumference of the diaphyses of long bones without compromising their vitality. Some delay in union, only, is met with when a bone so treated is fractured within the denuded area. That the membrane is one factor in supporting the life of the bone, but not an essential one under these conditions, is proven and conceded.

When, however, more or less permanent exposure of bone devoid of its investing membrane exists, or the factor of infection down to the actual surface of the bone is present, the understanding as to the ability of the bone to maintain its vitality, unaided by the presence of the periosteum, does not seem to be so clear. The uncertainty on this point, considering its importance, would seem to call for as positive a pronouncement as the state of understanding will permit.

The writer well recalls his own early troubles in gaining a clear conception of this question. Such a statement as the following—a quotation from a standard work of the day, under the heading of bone inflammation—indicated, perhaps, the surgical trend: "If inflammation is acute, the circulation is stopped, the tissues perish and gangrene (necrosis) occurs. In compact bone this is the rule. Acute inflammation, if it is not followed by immediate resolution, ends in necrosis. If the periosteal surface is involved (acute periostitis), the sequestrum as it is called, is superficial."

Ashurst, under the heading, Periostitis, wrote less discouragingly: "There may be a rapid formation of pus, when necrosis of the subjacent bone is apt to follow."

* Read before the Alameda County Medical Association, March, 1914.

Some years later Parke writes: "If pus forms and the periosteum is separated from the bone, there is a probability of acute necrosis of the shaft."

One could imply from these, if he possessed a surgical optimism, that sometimes the opposite happened and the bone, to some extent at least, might not perish.

With the possible writing of this paper in mind and to determine if his personal difficulties along this line have been shared by others, inquiry has been recently made of a number of medical men. Some were not long from the medical schools, others were graduates of former days and men of considerable experience in general surgery. The question has been asked, What is the prognosis as to the life of the bone in the presence of a suppurative process involving the periosteum and laying bare the bone? The replies have, with a single exception, been that it necessarily meant the death of the bone, either superficially or to a greater extent. One man, skilled and experienced enough to do a successful intestinal anastamosis, replying to the writer's question as to the prognosis in a neglected felon case in which a probe passed through a sinus disclosed denuded bone, said that it meant death of the phalanx and amputation. If he had chosen to do so, could he not have quoted Von Bergmann who, writing of "osseous panaritium," states: "If the diagnosis is still uncertain (after the perforation of pus), the probe will demonstrate a sequestrum of the larger part or the whole of the phalanx"?

One physician—the exception above noted—replied that the *extent* of the separation or loss of the periosteum would determine whether any necrosis would result. Somehow the emphasis seems to have been so long and forcibly laid on the fact that bone death is so much to be feared and expected under these conditions that apparently the possibility of that end not resulting is too largely overlooked. The hopeful side of the proposition is not the emphasized side, and our prognoses are, I fear, at times unnecessarily gloomy and our treatment perhaps on occasion too radical.

MacEwen must have had the impression that a wrong understanding of this question existed in some quarters, at least, when he recently wrote: "Bone bereft of its periosteum does not therefore die, and the mere detection of bare bone by a probe is no reason for believing that such bone is either dead or must die. If otherwise healthy, such a bone is capable, not only of living, but of performing its function and proliferating if need be."

This authority, you will note, hinges the possibility of the life of the bone being sustained in the absence of periosteum, upon the existence or absence of coincident bone disease. It is not altogether clear that he had infectious processes in mind. The question at once suggests itself, Can the bone itself be normal under these conditions? Can the pathology advance only to the bone surface and be limited to that plane, and not coincidentally to some extent penetrate the osseous tissue?

The life of the bone is maintained and dependent upon two sources of blood supply: First, *principally* from the nutrient arteries; and, second, from the arterial blood supply of the periosteum. The latter, at frequent intervals, sends off its arterioles to the subjacent bone. These enter the haversian canals and subdivide, nourishing especially the peripheral lamellae of the bone, anastamosing with the blood channels from the nutrient arteries.

The fact is well established by clinical evidence that when the inflammatory process accompanying an infection advances only to the periosteum, that the vitality of the membrane can well be maintained. In a very positive sense, then, the periosteum protects the subjacent bone when its integrity is jeopardized by advancing infection.

There can be no doubt, either, that the free intercourse of blood in the superficial parts of the bone from the two independent systems accounts also for the ability of the bone to maintain its nutritional integrity when under aseptic conditions it is deprived of its periosteum.

Whether in the presence of a *suppurative process* which has either destroyed or separated the periosteum from the bone, it is possible for the superficial parts of the bone at least, to continue to live, will depend on the extent of the thrombosis in the arterioles coursing from the periosteum to the bone beneath. The deeper layers of the periosteum are areolar in character, and through this more loosely constructed tissue the arterioles advance toward the bone, and it is not difficult to imagine that in the presence of a relatively mild infection the process of thrombosis progressing ahead of the inflammatory zone as the infection invades the deeper layers of the periosteum, might advance only to the bone surface and there be stayed. If this is the limitation of the process of thrombosis, the circulation in the haversian canals of the superficial bony lamellae, ordinarily supplied by the periosteal vessels, can still be maintained by the endosteal vessels. Thus, on *a priori* grounds, the maintenance of the life of the bone when deprived of its periosteum, would seem possible not only under aseptic conditions, but in the presence even of infection as well.

But, after all, the final verdict must rest, not with theory, but with experience. Let me present concisely two clinical cases which enforce the point that apparently needs general emphasis at this time —that bone deprived of its periosteum and even in the presence of infective suppurative process may still be capable, in some cases, of maintaining its vitality.

A good many years ago I was doing a sequestrotomy in the femoral shaft of a Portuguese lad of about fifteen years of age. After the involucrum had been chiseled away sufficiently to permit the removal of the sequestra and all diseased parts of the bone had been cut out, there remained less than half of the transverse diameter of the femur. Extending entirely across the portion of the shaft remaining there was a strip of bone three-fourths of an inch or more wide devoid of periosteum. The exposed surface of the femur was smooth, and where it was open to inspection had something of a pearly hue, entirely different from the

pink, healthy appearance of bone from which the periosteum has been recently separated. To have removed this exposed portion of bone, besides being very difficult on account of its deep and unapproachable location, would have jeopardized the integrity of the shaft and have made it likely that fracture of the femur would be a superadded complication. It was therefore decided to adopt a conservative course. According to the mode of the time, the bone cavity was packed with iodoform gauze, the soft parts allowed to fall into place. The wound pursued the usual course in such conditions, and the bone cavity rapidly filled in and the entire wound promptly cicatrized over. No fistula remained as I feared would result. The deep location of the bone did not facilitate examination of the portion devoid of periosteum, but there was nothing in the process of healing or after history to suggest the occurrence of even superficial necrosis where the femoral shaft had been deprived, by infection, of its protecting membrane.

A recent experience again illustrates this same truth. A middle-aged man presented himself at my office with a paronychia of the left middle finger. The infection had resulted from a laceration at the finger tip some ten days previous, and when he came to me a well-developed phlegmon existed on the left side of the nail near the base. This was promptly incised. Examination showed no exposed bone. A few days later swelling on the opposite side of the nail developed, and this was likewise incised. Through this latter incision the probe could be readily passed to the anterior surface of the base of the terminal phalanx, and when moved transversely to the long axis of the finger showed that the periosteum was either destroyed or separated across the entire width of this part of the bone—close to half an inch. The vertical extent of the denuded bone was not determined. Free drainage was maintained and in a few days, as soon as the amount of suppuration was somewhat diminished, Beck's bismuth-vaseline paste was injected. Pus production immediately practically ceased. On the following day, only, another quantity of the paste was forced in. The sinus promptly healed, and the finger has since remained sound.

Not the fact that infection has reached the surface of the bone; not the fact that a greater or a lesser extent of bone has been deprived of its periosteum in the presence of infection, but rather this: the extent to which the process of arterial and capillary thrombosis has advanced, whether to or within the osseous structure, determines whether the bone vitality may be maintained or necrosis will result. Early incision, free drainage, may be deciding factors in the outcome. And when bare bone is detected, at least for a while, until the *tactus eruditus* determines that necrosis has actually occurred, a Wilsonian attitude of "watchful waiting" is justified and something of hope may rightfully lighten our prognosis.

Furthermore, when ostitis and bone death result from periosteal infection, and is unassociated with the obstruction of more or less of the major circulation of the bone from the nutrient vessels, such as occurs in osteomyelitis, it will rarely happen that anything more than a superficial necrosis —one involving the outer lamellae only—will result.

THE UTILITY OF CATARRHAL VACCINES.*

By FRANCIS WILLIAMS, M. D., San Francisco.

My attention was drawn to catarrhal vaccine a year ago, while seeking to cure my little daughter of a persistent recurring rhinitis, similar in nature to an affection which a year prior existed in her brother, terminating as an acute infective cellulitis of the cervical and mediastinal regions, the adenoid tissue acting as port of entry, so causing the first infection of his life at 2 years of age to end fatally. With this in mind, I gave one-half ampoule of Sherman's No. 7, containing:

Micrococcus catarrhalis.....50 mill.
Pneumococci .....20 mill.
Streptococci .....15 mill.

An increased and watery secretion from nares followed for 12-24 hours, then cessation for one week. A slight recurrence required a second injection, with similar increase ensuing followed by freedom from all catarrhal affections from April to February, when she passed through a brief attack of grippe, and in March, incipient pertussis, both of which seemed to yield quickly to vaccines.

From last December to the present date there have occurred many cases of intractable recurrent "colds," tonsillitis, pharyngitis, and rhinitis. During this period I have used catarrhal vaccine in 32 cases, giving about 70 injections. The cases were divided as follows:

Recurrent "colds" and rhinitis.....	8
Tonsillitis and pharyngitis.....	9
Bronchopneumonia (1 post pertussal).	2
Pertussis	6
Spasmodic cough with catarrhal conditions	5
Chronic laryngitis.....	1
Prophylactic	1

Results:

Improvement marked with 1st or 2d injection	22
Moderate—ran a course but moderated	8
None (Pertussis in adult).....	1
No data (Chronic laryngitis).....	1

Typical Cases:

Quinsy. Mrs. W., aet. 22, severe quinsy with membrane one month prior. Swab negative, but given 2000 units diphtheria antitoxin with prompt recovery. Second attack December 3. Feared antitoxic serum because of anaphylaxis. Resisted all usual treatment and began to invade peritonsillar tissue, with rise of temperature. Gave 100 mill. Micr. catarrh., etc., at 11 a. m. At 6 p. m. patient was distinctly improved and recovery was very rapid during following two days. This, of course, represents extreme of favorable result.

Mr. McN., aet. 38, represents a more discouraging type. Ill several days when first seen, with

* Read before the San Francisco County Medical Society, May 5, 1914.